OCR
Oxford Cambridge and RSA

Monday 11 January 2016 – Afternoon

LEVEL 1 CAMBRIDGE NATIONAL IN SCIENCE IN THE WORKPLACE

R075/01 How scientific data is used

Candidates answer on the Question Paper.
A calculator may be used for this paper.

OCR supplied materials:
None

Other materials required:
- Pencil
- Ruler (cm/mm)

Duration: 1 hour

Candidate forename		Candidate surname	

Centre number						Candidate number				

INSTRUCTIONS TO CANDIDATES

- Write your name, centre number and candidate number in the boxes above. Please write clearly and in capital letters.
- Use black ink. HB pencil may be used for graphs and diagrams only.
- Answer **all** the questions.
- Read each question carefully. Make sure you know what you have to do before starting your answer.
- Write your answer to each question in the space provided. If additional space is required, you should use the lined page(s) at the end of this booklet. The question number(s) must be clearly shown.
- Do **not** write in the bar codes.

INFORMATION FOR CANDIDATES

- The number of marks is given in brackets **[ ]** at the end of each question or part question.
- The total number of marks for this paper is **50**.
- The quality of written communication is assessed in questions marked with a pencil (✎).
- This document consists of **20** pages. Any blank pages are indicated.

Answer **all** the questions.

1 A student called Ned monitors rainwater as part of a school project.

(a) He does a titration to find out how much acid is in the rainwater.

He uses his titration to measure how much sodium hydroxide solution reacts with a sample of rainwater.

Here is the procedure he follows but the steps are in the wrong order.

A	Add a few drops of indicator.
B	Fill the burette with sodium hydroxide solution and note the starting volume.
C	Note the volume reading on the burette.
D	Put a sample of rainwater in a conical flask.
E	Slowly add sodium hydroxide solution until the indicator changes colour.

Fill in the boxes to show the correct order of the steps he follows.

The position of step **B** has been filled in for you.

		B		

[3]

(b) Ned repeats the titration with another sample of the same rainwater.

How does this improve his results?

.....

..... **[1]**

(c) A colleague of Ned's also does a titration using a sample of the same rainwater and the same sodium hydroxide solution.

His results are different to Ned's.

Suggest a reason why their results are different.

.....

..... **[1]**

(d) Suggest an alternative technique that could be used to improve the accuracy.

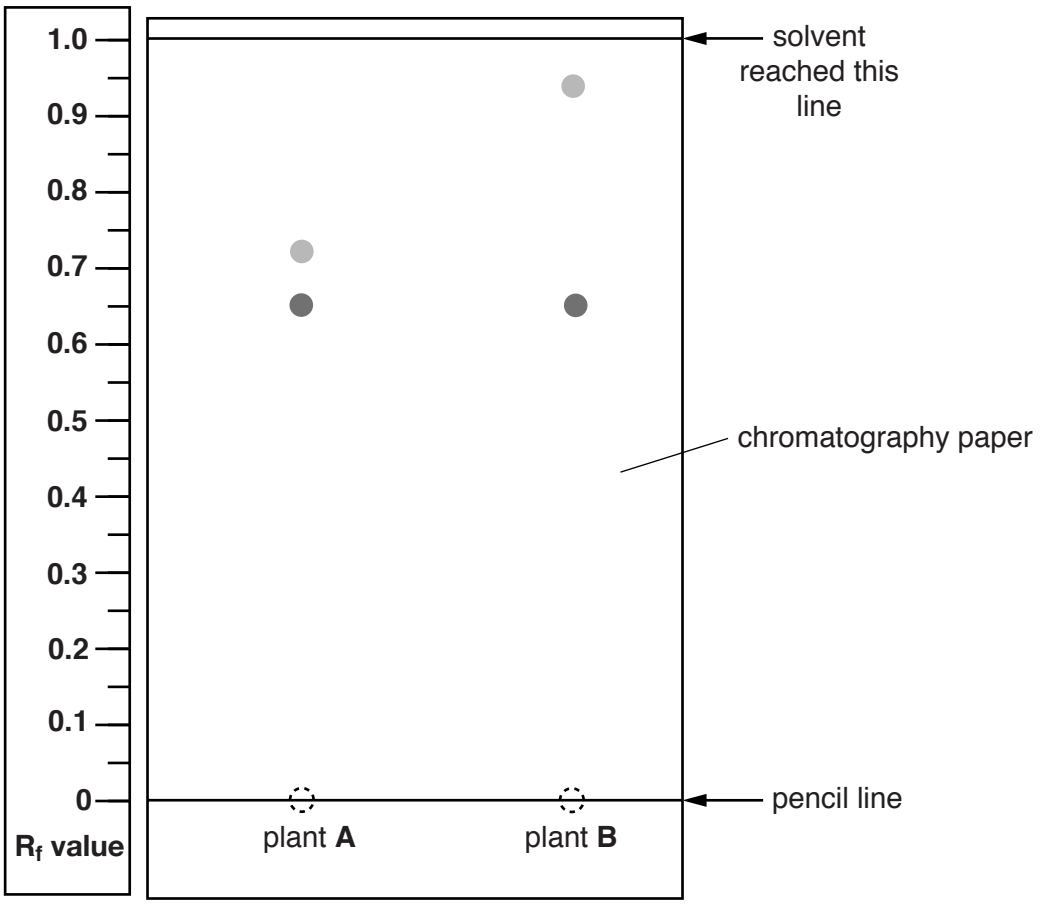
..... **[1]**

2 Jack works in a research laboratory.

Plants are coloured because they contain a mixture of pigments.

(a) Jack uses chromatography to identify the pigments in two plants, **A** and **B**.

Here is Jack's chromatogram with a scale marked with R_f values.



(i) Jack lets the solvent get near to the top of the chromatography paper.

How does this help him to get accurate results?
Put a tick (✓) next to the correct answer.

It gives as many spots as possible. ☐

It shows the strongest pigment. ☐

It separates the spots as much as possible. ☐ **[1]**

(ii) Jack observes that the lower spot for each extract looks blue-green.

Are Jack's observations **qualitative** or **quantitative**?

Explain your answer.

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..... **[1]**

(iii) Jack concludes that one of the pigments is the same in both plant **A** and plant **B**.

How does the chromatogram show this?

.....

..... **[1]**

(iv) Jack uses this data table to help him identify the pigments.

Pigment	**Colour**	**R_f value**
Carotene	yellow	0.94
Phaeophytin	yellow-grey	0.83
Xanthophyll	yellow-brown	0.72
Chlorophyll	blue-green	0.65

Which pigments are in plant **A**?

Use the chromatogram with the R_f scale and the data table to help you.

Put (rings) around the **two** correct answers.

carotene **phaeophytin** **xanthophyll** **chlorophyll** **[2]**

(v) How does the chromatogram show that carotene is in plant **B**?

.....

..... **[1]**

(b) Jack uses another technique to find out what pigments are in the plants.

This new technique is called absorbance spectrophotometry.

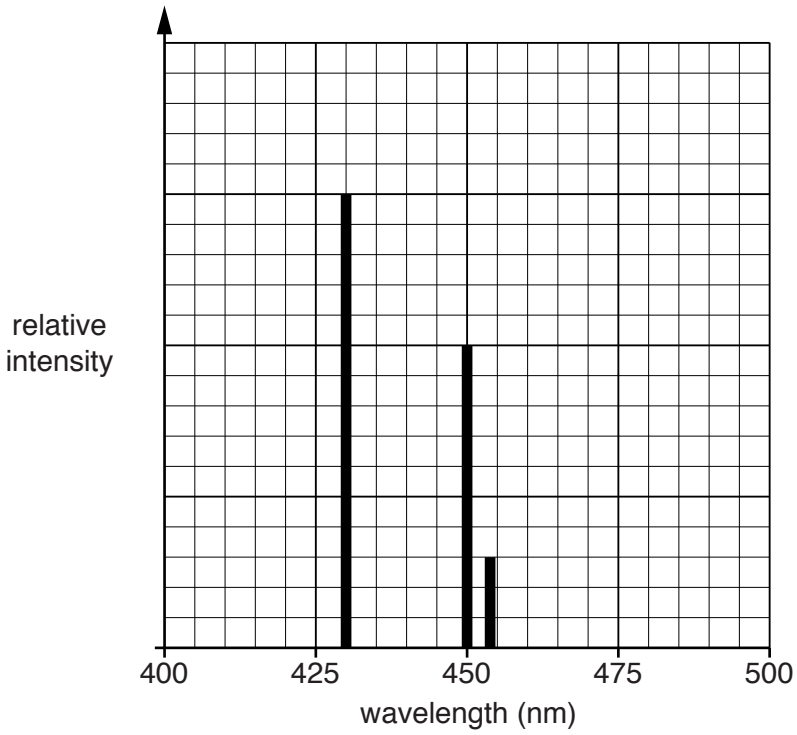
(i) Give **one** benefit of using two techniques to make a conclusion.

.....

..... **[1]**

(ii) Jack uses the absorbance spectrophotometer to find the pigments in another plant, plant **C**.

This is his result.



He uses this data table to make his conclusions.

Name of pigment	**Wavelength (nm)**
Phaeophytin	410
Chlorophyll	430
Carotene	450
Xanthophyll	494

Use the graph and data table to make conclusions about the pigments in plant **C**.

Give evidence for each conclusion.

The quality of written communication will be assessed in your answer.

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..... **[6]**

3 Lucy, Matt and Amy monitor the quality of water for an environmental organisation.

(a) Lucy uses Universal Indicator paper to test the pH of water at various locations.

Here are her results.

Location	Colour of Universal Indicator paper
Lake	green-blue
River	green-blue
Tap	yellow
Well	green

Here is the colour chart she uses to interpret her results.

4	5	6	7	8	9	10	11
orange	yellow	lime-green	green	green-blue	turquoise	pale-blue	blue

Is the water from each location **acidic**, **neutral** or **alkaline**?

Put **one** tick (✓) in each row.

Location	Acidic	Neutral	Alkaline
Lake			
River			
Tap			
Well			

[3]

(b) Lucy takes samples of water from each of the locations back to the laboratory and uses a pH meter to test them.

Here are her results.

Location	pH
Lake	7.9
River	8.3
Tap	6.3
Well	6.9

(i) Explain why water from the lake and the river both go green-blue, pH 8, when Universal Indicator paper is used, but they have different values when using the pH meter.

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..... **[1]**

(ii) Give **one** advantage of using a pH meter compared with using Universal Indicator paper.

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..... **[1]**

(c) Matt tests for ions in the tap water.

He puts some tap water in a beaker and leaves it until all of the liquid has evaporated.

He uses a flame test to test the solid residue left in the beaker.

Matt follows this procedure:

Step 1 – Dip a wire loop in concentrated acid.

Step 2 – Put the wire loop in a Bunsen burner flame.

Step 3 – Dip the wire loop in the solid residue.

Step 4 – Put the wire loop in a Bunsen burner flame.

(i) Why does Matt do steps **1** and **2**?

Put a tick (✓) next to the correct answer.

to make the solid residue stick to the wire	☐
to find out what colour the acid gives	☐
to make the colour stronger	☐
to clean the wire	☐

[1]

(ii) The flame goes red.

Matt uses this data table to identify the metal ion.

Metal ion	Colour of flame
Barium	green
Calcium	red
Potassium	lilac
Sodium	orange

What metal ion is in the residue?

..... **[1]**

(iii) How could Matt check that his result is reliable?
Put a tick (✓) next to the correct answer.

Keep the wire loop in the Bunsen burner flame for longer. ☐

Dip the wire loop in a different concentrated acid. ☐

Repeat the same test. ☐

Use a different technique. ☐ **[1]**

(d) Amy uses test solutions to find out what ions are in the water from the well.

She uses sodium hydroxide and silver nitrate test solutions.

This is the data table she uses to make her conclusion.

Test solution added	Observation	Ion present
Sodium hydroxide	blue precipitate	Copper
Sodium hydroxide	white precipitate	Magnesium
Sodium hydroxide	green precipitate	Iron(II)
Silver nitrate	yellow precipitate	Iodide
Silver nitrate	white precipitate	Chloride
Silver nitrate	cream precipitate	Bromide

Amy concludes that the water contains **magnesium** ions and **chloride** ions.

What colour is the precipitate she sees for each test?

Sodium hydroxide test .....

Silver nitrate test .....

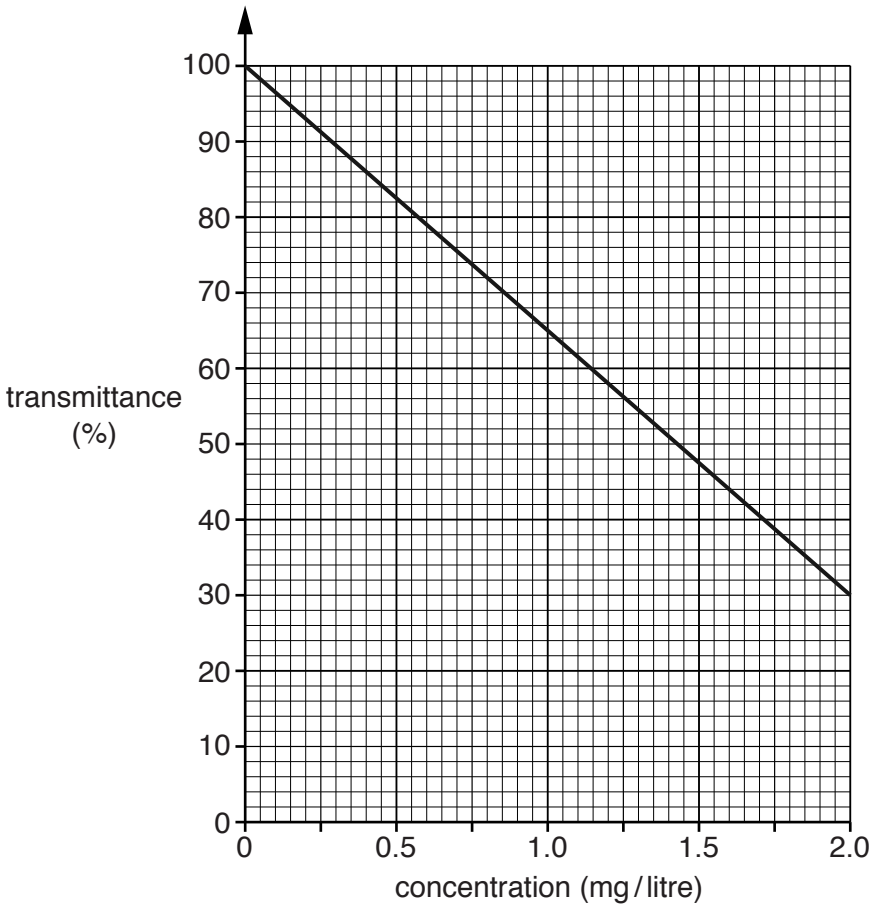
[2]

4 Liam works for Environmental Health.

He tests water from swimming pools.

He uses a transmittance colorimeter to measure the concentration of chloride ions in the water.

This is the **calibration graph** he uses.



Here are his results for two swimming pools, **A** and **B**. The tests were taken one after the other.

Swimming pool	Transmittance (%)					
	Test 1	**Test 2**	**Test 3**	**Test 4**	**Mean**	**Range**
A	74	77	76	77	76	74 to 77
B	62	68	85	65		

Liam uses the calibration graph to calculate the mean concentration and its range.

For swimming pool **A**, he finds a mean concentration of 0.70 mg / litre with a range of 0.65 to 0.75 mg / litre.

The recommended **safe** concentration of chloride ions is from 0.4 to 1.0 mg / litre.

Swimming pool **A** is within the recommended safe concentration range.

Is swimming pool **B** safe for people to use? Use the data in the table to calculate the mean transmittance and the range in transmittance for swimming pool **B**.

Explain your working and give reasons for your answer.

The quality of written communication will be assessed in your answer.

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..... **[6]**

5 Jess works in the pathology laboratory at a hospital.

She examines a specimen of tissue taken from a patient.

(a) Jess looks at the specimen using a hand lens (magnifying glass).

Which of these features is she able to see using the hand lens?

Put a tick (✓) next to each feature she can see.

the colour of the specimen	☐
the diameter of one cell	☐
the size of the specimen	☐
the structure of a cell	☐

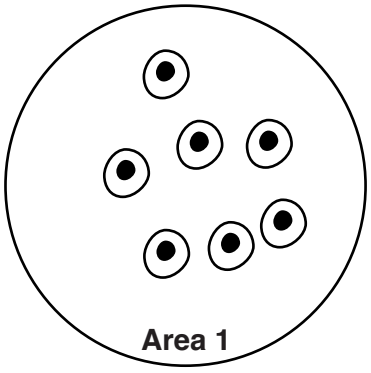
[2]

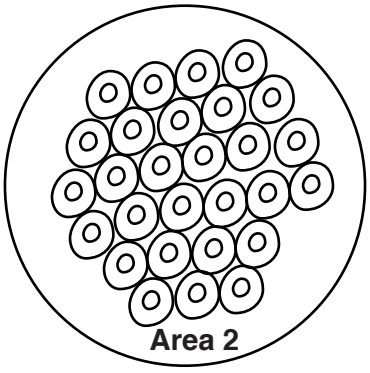
(b) Jess then uses a light microscope to look at the specimen.

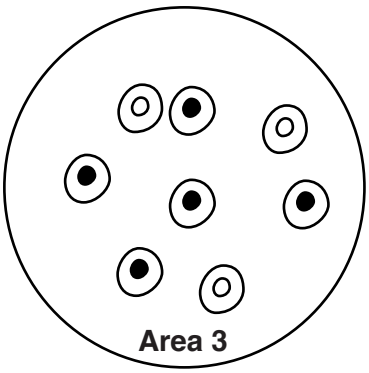
She looks for abnormal cells, which look like this:

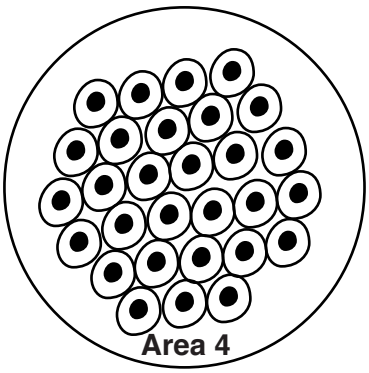
Jess examines four areas of the specimen using the light microscope.

This is what she sees.









Which areas show abnormal cells?

Put a (ring) around each correct answer.

Area 1 **Area 2** **Area 3** **Area 4** **[2]**

(c) Jess makes the image for Area 2 larger so that she can see more detail.

How does she do this?
Put ticks (✓) next to the **two** correct answers.

She adjusts the eyepiece lens. ☐

She moves the specimen nearer the objective lens. ☐

She uses a brighter source of light. ☐

She uses an electron microscope. ☐

She uses a more powerful objective lens. ☐ **[2]**

6 Tom works for the World Anti-Doping Agency.

He tests blood specimens taken from athletes to see if they have used any banned drugs.

He receives blood specimens from all the athletes attending a sporting event.

There are male and female athletes from a number of different countries.

(a) (i) Tom cannot test all the blood specimens so he samples them.

Describe how he picks a **representative** sample from the blood specimens.

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..... **[2]**

(ii) Suggest **two** things that the people sending the blood specimens to Tom should do to make sure that the specimens are not contaminated.

1 .....

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2 .....

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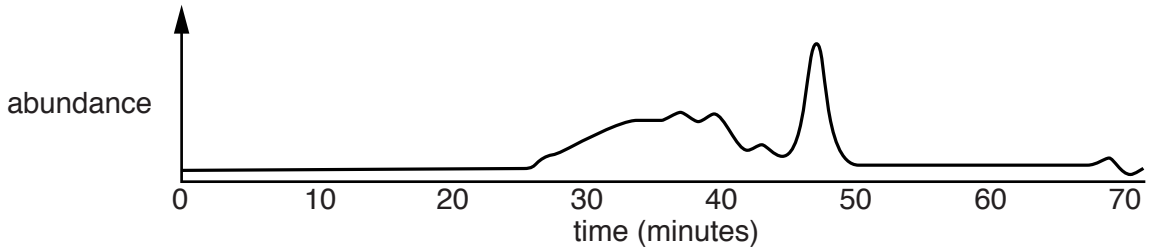
[2]

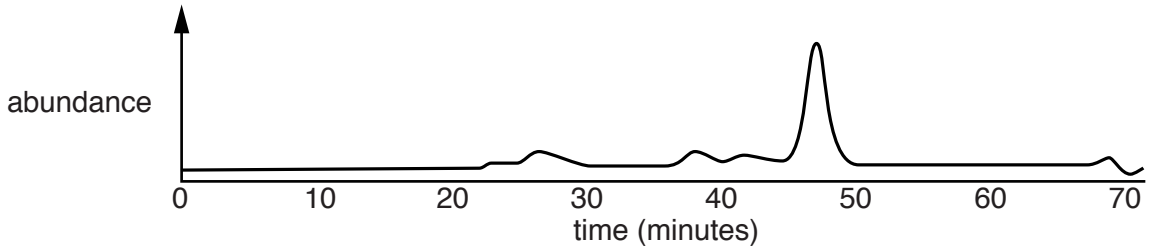
(b) Tom uses a high performance liquid chromatography (HPLC) technique to analyse two of the blood specimens, **A** and **B**.

These are his results.

Specimen A

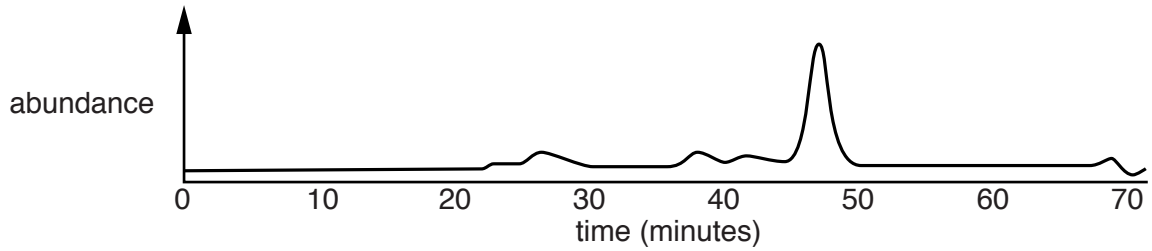


Specimen B



Tom uses the data below to help him interpret his results.

Blood specimen – no drugs



Tom concludes that **specimen A** contains a drug but **specimen B** does not.

(i) Refer to the data to explain why he makes these conclusions.

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..... **[2]**

(ii) Describe how Tom can identify the drug in **specimen A**.

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..... **[2]**

(iii) Tom repeats his tests.

What else can he do to make his conclusions secure?

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..... **[1]**

END OF QUESTION PAPER

ADDITIONAL ANSWER SPACE

If additional space is required, you should use the following lined page(s). The question number(s) must be clearly shown in the margins.